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G E N E R A L

10 - 20 - 30

Department of Education

Edmonton, Alberta

September, 1968

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INDUSTRIAL ARTS GENERAL

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INDUSTRIAL ARTS GENERAL

Introduction

The Industrial Arts General course is designed to meet the needs of two groups of students; those that can benefit from additional exploration in greater depth of content in a number of selected areas before enrolling in vocational courses and two; those that wish to broaden their understanding of the major technologies and gain more skill in the crafts. In both cases the organization andaccommodation is such that the general program can best be carried out in a multiple activity laboratory.

Through the program students are able to work in an environment which is conducive to challenging their intellect and talents in a number of technical and craft areas. Students become aware of the interrelationship and the dependency of one technology upon the others. They have the opportunity to develop broad concepts of the principles and skills required in the various occupations. Students will find it necessary to apply many of the skills they have developed in other school subjects to the solution of practical problems.

This course can contribute greatly to achieving the objectives of secondary education in this province.

General Objectives

Industrial arts is a part of general education and as such instructors need to understand the objectives of the Alberta education program.

A. Functional Objectives of the Alberta Secondary Schools

1. Personal Development
2. Growth in Family Living
3. Growth Toward Competence in Citizenship
4. Occupational Preparation

OBJECTIVES OF THE SENIOR HIGH SCHOOL INDUSTRIAL ARTS PROGRAM

The industrial arts program helps to attain the functional objectives of Alberta Secondary School Education as set forth above.

Within the scope of these general objectives the unique contributions made possible through Industrial Arts courses are summed up in the following objectives:

Industrial arts courses will provide an opportunity for students:

1. To develop an understanding of related technological clusters and the interrelationship of the technologies within the cluster areas.

2. To develop an understanding of the applications of the academic disciplines in an industrial environment.

3. To study and work in an environment which stimulates the individual to discover and develop his interests and talents.

4. To develop an understanding of man's changing role in an advancing industrialized society.

5. To develop sound safety attitudes with respect for safe working habits and practices in the use of tools, equipment and materials.

6. To develop personal and social responsibility.

7. To develop a degree of skill necessary to satisfactorily perform the operations and processes required by the curriculum.

Definition of Terms

1. Multiple Activity Laboratory - a laboratory where three or more activities are in progress at the same time.

2. Area Laboratory - a laboratory in which a cluster area is taught, e.g. Electronics 10, 20, 30 would be taught in an Electronics laboratory; Materials in a Materials laboratory.

3. Cluster - or cluster area - the technologies and crafts that are closely related are grouped in clusters. Four main clusters have been developed in the Alberta Senior High School Program:

   Electronics - made up of Electricity, Electronics, Computer

   Materials - Wood, Metal, Plastics, Craft Materials

   Graphic Communications - Drafting, Photography, Printing, Duplicating

   Power Mechanics - Vehicle Maintenance, Power Sources, Electrical Systems, Power Transmission

4. Course Unit - a unit consists of from 9 - 10 weeks of work in a specific area. All the industrial arts courses, both the General and the Cluster courses, have four units of work each year.

Description and Scope of the Program

The four units that comprise a year's work in each of the three years the program is taught are selected from a total of twenty-one. The selection is made as follows: Units must be choosen from three different cluster areas. Two units may be chosen from one cluster and the other two from two different clusters. The special units cluster does not represent any special technology or craft but supplies units to make the course more flexible, expecially in labs with limited facilities. Different units must be chosen for each year of the program.

For students using the Industrial Arts General course for guidance purposes as an introduction to vocational should be given units chosen from the first four clusters.

Scope

The Industrial Arts General courses 10. 20, 30 are a series of four- five credit courses built up by selecting four units from three different clusters as listed below. The numbering 10, 20 and 30 is determined by the number of units the student has completed. The first four units are designated Industrial Arts General 10, the second four or total of eight are Industrial Arts General 20 and the third four become Industrial Arts General 30.

A	Electronics	1. Basic Electricity-Electronics 2. Systems Study 3. Units of a System 4. Components of a System
B	Materials	5. Wood 6 Metals 7. Plastics 8. Crafts or Textiles
C	Graphic Communications	9. Drafting 10. Photography 11. Printing Processes 12. Printing Con't.

D	Power Mechanics	Power Sources - Internal Combustion 13. Two Cycle Engines 14. Four Cycle Engines Power Transmission 15. Power Transmission - Mechanical 16. Power Transmission - Hydraulics
E	Special Units For Industrial Arts General	17. Research 18. Production Science 19. Hot Metals 20. Building Construction 21. Food Science

Many instructors will find it advantageous to offer the general course as well as a cluster course. When this is done units for the general course should be chosen from the clusters other than the one taught as a cluster, e.g. if Electronics 10 is to be offered in conjunction with Industrial Arts General 10 to the same students then the units selected for Industrial Arts General 10 should not include any Electronics.

Some Suggested Unit Selections

1. In centers offering Industrial Arts General 10 and 20:

   Unit 1, 5, 9, 13
   or
   1, 6, 11, 13
   or 1, 7, 10 17 or 18
   or 5, 8, 9, 21
   or etc.

2. In centers offering Industrial Arts General 10 and 20:

   Industrial Arts General 10 - Units 5, 6, 9, 13
   or
   1, 5, 9, 13

   Industrial Arts General 20 - Units 1, 2, 11, 17
   or
   2, 6, 10, 18
   etc.

3. In centers offering Industrial Arts General 10, 20 and 30:

   Industrial Arts General 10 -- 5, 6, 9, 13 or 7, 8, 11, 17

   Industrial Arts General 20 -- 1, 2, 7, 11 or 5, 6, 10, 13

   Industrial Arts General 30 -- 3, 4, 8, 10 or 1, 2, 9, 19

4. Centers wishing to offer an Industrial Arts General course that utilizes both the industrial arts and home economics laboratory can select the units textiles and foods to be taught in the home economics room and two other units like wood and drafting or some other combination to be taught in the industrial arts laboratory.

Shop Organization and Equipment

In a single, comprehensive general shop or multiple-activity laboratory the units will be taught by planning activities in three or four different areas to be carried on simultaneously. In this way both equipment and space can be utilized to best advantage.

Each unit required nine to ten weeks of work. The class should be divided into four groups with each group completing the learning experiences planned for each unit before moving to the next.

Equipment should be available to satisfactorily complement the instruction content before such a unit is attempted.

Transition

The Industrial Arts General sequences of courses will replace General Mechanics 15, 16 and 17. No serious difficulties should be encountered in offering the new program, expecially if the junior high school program has been provided for. Special allowances will be made during the transition period (to 1967). The Supervisor of Industrial Arts, Department of Education, must be notified of deviations from the standard program or credits may be withheld.

How To Use This Guide

Once you have selected the units for each year's program determine how best you can meet the objective of industrial arts. Each unit is written to indicate the activities a student does under the "do" column and the information he should acquire under the "know" column. The numbers in both columns are matched so that the appropriate learning experience coincides with the activities.

Method of Procedure

1. Select the units you plan to teach in each grade.

2. Study each unit. Read the material in the reference books and manuals. Then develop a series of lessons or activities to cover the content in the "know" column. Plan appropriate student activities as suggested in the "do" column.

3. Select or prepare audio-visual materials such as films, filmstrips, charts, etc., that will reinforce your lesson material.

4. Develop instruction sheets where they can be used to best advantage.

5. Study the requirements in equipment and materials so that these can be arranged for in time.

6. Prepare a tentative plan for the whole year. Use it as a guide. Have dates for unit changes set and try to remain on schedule.

7. Prepare a daily plan and list all lesson topics and students' activities a week ahead of time.

Administration

1. Time - Each of these courses may be offered for four-five credits. the number of minutes required per credit should conform with the regulations described in the Senior High School Handbook.

2. Scheduling - Industrial Arts courses can be satisfactorily taught in blocks of time from 60 to 160 minutes. Double period blocks twice a week have proven very successful.

3. Class Size - A maximum class size of twenty is suggested. When student numbers go beyond that, student and teacher efficiency is seriously hampered because of insufficient space and equipment. Industrial Arts laboratories in this province are not planned to cope with numbers larger than twenty.

4. Records - Every instructor should keep the following records:

   (a) Enrolment and attendance
   (b) Daily lesson plan
   (c) Yearly plan
   (d) Record of student achievement
   (e) Inventory of equipment and supplies.

   It is recommended that the records be kept in a simple, efficient manner.

5. Student Evaluation - Evaluation must be based on what the student has learned "know" and what he has done "do". The following is a suggested criteria for grading students.

Related Theory - tests, written exercises, reports ("Know" Column)	50%
Activity - projects experiments, operations performed ("Do" Column)	50%

Safety Program

Every school must have an effective safety program. This does not mean that the promulgation of a set of rules and regulations will satisfy this end. Students must be taught in each and every subject studied within the industrial arts framework, the "hows and whys" inherent in the safety program. It is the responsibility of the instructor to supply continuous and vigilant supervision and to ensure that all students engage in only safe shop practices. A good safety program would include:

1. Regular and thorough instruction
2. Constant vigilance.
3. Checking and evaluating of student safety habits by the instructor.
4. Complete first aid equipment kept in first-class condition.
5. Non-skid paint and clearly marked working areas around all machinery.
6. Proper clothing with particular attention to eye protection.
7. Machines and tools in good working condition.
8. Routine reporting of all accidents.
9. Good housekeeping.

The following is a sample of safety regulations which the instructor mighbe be expected to enforce:

1. No power machines shall be used by any student before specific instruction has been given with regard to safe operation and safety precautions.
2. No power machine shall be used while the instructor is absent from the shop.

3. No machine shall be used by any student unless it is adequately guarded.

4. Approved eye protection must be worn for certain operations.

Note: A good safety slogan which should be put into practice at all times - a place for everything and everything in its place.

There are five basic steps in safety education:

1. Set a good safety example for the students.

2. Instruct each student thoroughly in the safety precautions of his job.

3. Keep al tools sharp and in good condition.

4. Keep all safety devices in proper use.

5. Follow up safety instructions constantly. The shop will be as safe as the instructor makes it.

Dress and deportment play an important part in the operation of a safe I.A. program. Students and instructor should be neatly dressed at all times and the instructor should take care to ensure that no loose and dangerous clothing is worn. Safety aprons, goggles, gloves, should be used wherever necessary.

It should be pointed out that failure to comply with every reasonable safety precaution, may jeopardize the instructor's position in any claim for compensation. Each school should receive the excellent publications and bulletins dealing with accident prevention and safety procedures distributed by the Workmen's Compensation Board.

Note: Accidents must be promptly reported to some senior school authority. If no other person is designated, this authority is the Principal.

A. ELECTRONICS

Introduction

The approach to teaching electronics in the industrial arts courses is to develop broad concepts of the underlying principles operative in electronic equipment.

The four units to be used as a part of the general program will introduce a student into

1. the total system of an electronic device such as a record player
2. the units that form the system e.g., the power supply, amplifier, etc.
3. the components that make up the unit and finally
4. the scientific principles involved in the operation of the device.

Students will become familiar with and learn how to use safely and correctly the common measuring instruments necessary for the diagnosis and analysis of the systems he will study.

Objectives

1. To teach the correct use of common and special instruments and principles involved.

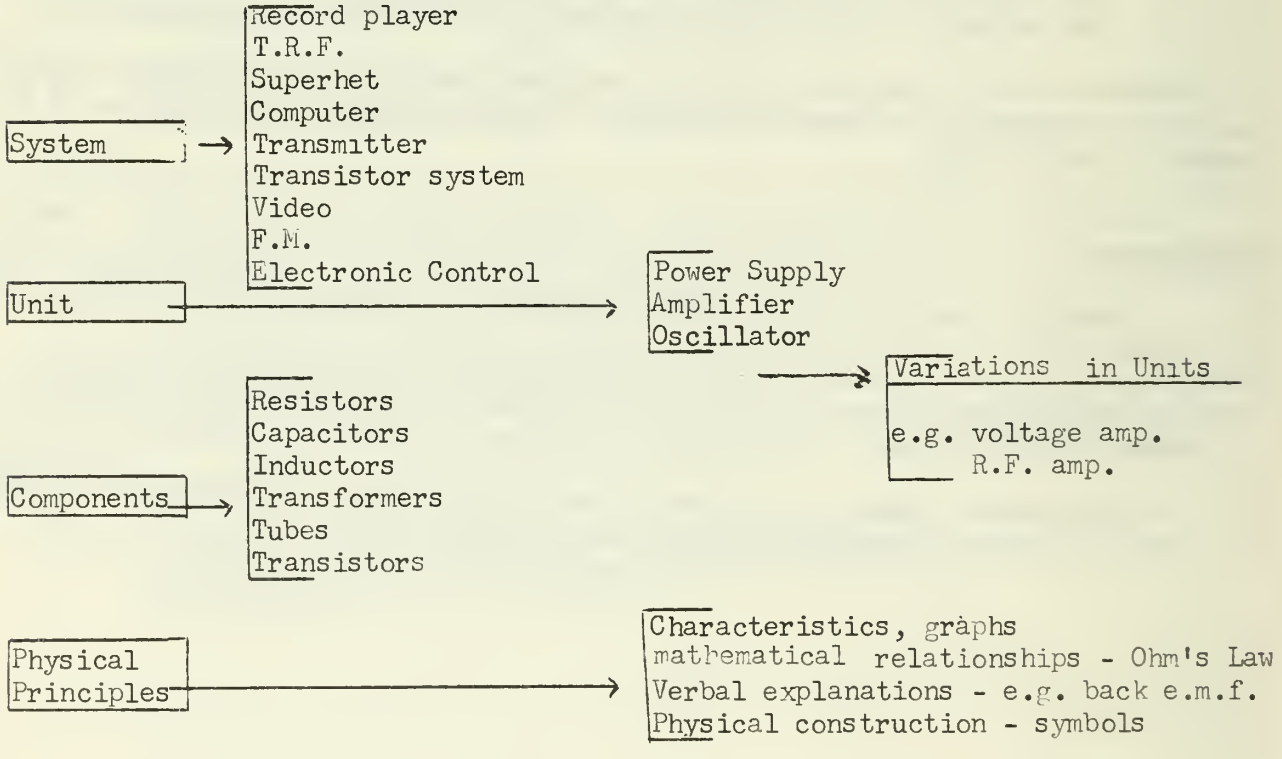
2. To familiarize students with some of the basic electronic circuits and their applications.

3. To familiarize students with the basic principles and fundamentals of radio and television communications and computer systems.

Time Distribution

Electronics 10	20	30
2/3 Systems	Systems	Systems
	Units	Units
1/6 Units	Components	Components
1/6 Components		

Block Diagram of Systems Approach



INDUSTRIAL ARTS, GENERAL 10

A. ELECTRONICS

Unit 1 Basic Electricity - Electronics

Course Content

What the student should be able to:

DO	KNOW
1. Films Demonstrations	1. General Information - Safety - Symbols - Schematics
2. Measurement - Voltage - Resistance - Current	2. Instrument Use - V.O.M. - V.T.V.M. - Oscilloscope - Ammeter - Voltmeter - Signal Generator
3. Identify blocks Measure voltage - input signal - output signal	3. (a) Study a minimum of two systems from the following - Record player - T.R.F. - Superhet - Computer (b) Overview of system - Identification of units - Block diagrams - Input - classification A.F. or R.F. - wave form - size - Output - classification - wave form - size

Unit 2 Systems Study

4. Identify blocks Measure voltage - input signal - output signal	4. Study a minimum of three of the following systems (do not repeat those studied in Unit 1) - Record player - T.R.F. - Superhet

	4. Cont. - Computer - Transmitter - Transistor - Video - F.M. - Electronic control (use same overview as under 3 (b))
5. Study function and operating principles of each unit.	5. The basic principles of operation of the following units from the systems studied above - Power supply - Amplifier - Oscillator

Unit 3 Units of a System

6. Assemble, test and compare units (bread boarding).	6. Variations of the units (a) Power supplies - Half wave - Full wave bridge (b) Amplifier - Audio frequency - Voltage and power - Radio Frequency (c) Oscillator - Armstrong - Hartley

Unit 4 Components of a System

7. (a) Measure and compare coded values with measured values (b) Identify and compare characteristics (c) Construction and production of components	7. Components (a) Resistors (b) Capacitors (c) Inductors (d) Transformers (e) Tubes (f) Transistors

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5. Vol. 1 to VI, Van Valkenburgh et al, Basic Electronics, John F. Rider
6. Markus, A., Basic Electronics, Prentice Hall
7. Lytel, Allan, A B C's of Computers, 1964, Howard W. Soms and Co.
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B. MATERIALS

(5) WOOD TECHNOLOGY

Course Content

What the student should be able to:

DO	KNOW
Layout and Design	
1. Do exercise based on blueprint reading.	1. How to read blueprints. - lines and symbols - types of projections.
2. Use measuring tools. - rule - try square - tape.	2. How to layout work in wood.
3. Use a marking knife, compass, dividers and marking gauge.	
4. Find examples of wood products that have good design.	4. Principles of good design. - balance - proportion - simplicity - proper selection of material and finish.
Sources and Applications	
5. Write out characteristics, source and best use of a number of selected woods. (a) Make tests comparing strengths of various woods.	5. Identification of common woods. - pine - fir - poplar - maple - birch - mahogany - walnut - ash - willow - red gum - cedar

DO	KNOW
Hand Processes	
6. Condition a jackplane - sharpen blade - tighten handles - adjust frog.	6. Care of edge tools. - personal safety - protection of cutting edges - prevention of breakage - tool conditioning.
7. Sharpen a chisel.	
8. Sharpen a bit.	
9. Tighten handle on a saw.	
10. Cut with a crosscut.	10. How to select and care for sawing tools (crosscut, rip, keyhole, coping, back).
11. Cut with a ripsaw	
12. Cut with a backsaw.	
13. Adjust plane.	13. How to select and use bench planes.
14. Square a board.	
15. Plane a chamfer.	
16. Plane a bevel.	
17. Pare with a chisel.	17. How to select and use a chisel.
18. Bore a hole to depth.	18. How to select and use boring tools.
19. Use a spakeshave to smooth inside curves and convex edges.	
20. Sand flat surfaces.	
21. Grind a chisel.	21. How to use a grind stone. - types of stones - speeds - cooling.

DO	KNOW
Machine Processes	
22. Use a band saw to cut curves in heavy stock.	22. Select and use abrasive papers. - garnett - flint - grit sizes - sanding blocks.
23. Turn a face plate project using correct chisels. (limit use of lathe)	23. How to use the lathe for - faceplate and spindle turning - speeds - use of chisels - safety precautions.
24. Rip with the circular saw.	24. How to use the circular saw for ripping and crosscut. - use of guards - safety precautions.
25. Crosscut with the circular saw.	
26. Edge plane a board.	26. How to use the jointer. - surface plane - edge plane - safety precautions.
27. Surface plane a board.	
Fasteners	
28. Fasten material with glue.	28. How to select and use fasteners. - glues - kinds, uses - screws - types, sizes - nails - types, sizes.
29. Test glue strength.	
30. Drive and set a nail.	
31. Drive a screw.	

DO	KNOW
Finishing	
32. Apply wood filler.	32. Common wood finishes.
33. Apply sealer.	
34. Apply oil finish.	
35. Apply varnish finish.	
36. Apply wax.	
Occupational Information	
37. Study your community and name all the people you know doing work that requires the skills of a woodworker.	37. Vocational areas related to woodworking.

Suggested Projects

- projects that involve the use of several kinds of materials.
- night table, coffee table, small cabinet type projects.

(6) METAL

Course Content - (Sheet metal and one of Machine Shop or Welding)

What the student should be able to:

DO	KNOW
Blueprint Reading - Layout & Design	
1. Sketch project.	1. Understand a working drawing.
2. Develop pattern	2. Parallel line development.
3. Make material list.	3. How to calculate cost.
4. Layout project.	4. How to mask metal - procedure steps
	5. Function and design from materials aspect.

Materials, Sources & Application

DO	KNOW
6. See film on the production of iron and steel.	6 The history of metals leading to the development of iron and steel.
7. Examine types of iron ore, coke, and limestone.	6. The iron ore - Hematite, Magnetite, Limonite, Taconite and their composition. - world distribution - methods of mining - transport
8. Take a piece of pig-iron or case-iron, Break, file, polish, etch and examine under a microscope.	8. The Blast Furnace - History, construction and operation - pig-iron and its constitution - crystal formation of pig-iron - slag and its uses or disposal - the cupola furnace and the production of cast iron - cast iron techniques.
9. Cut a piece of wrought iron - if available - and mild steel, polish and observe under the microscope.	9. Refining pig-iron. - the puddling furnace - Seimens open-hearth regenerative furnac - Bessemer converter - crucible furnace - electric arc and induction furnaces - methods of producing rods, bars, strips, sheet, tubes and wire, both hot and cold.

Hand Processes

10. Lay out patterns on sheet metal and bare using - steel square - steel rule - scriber - divider - trammel points - hemaprodite calipers - marking ink.	10. Layout procedures and tools.

DO	KNOW
11. Make sheet metal joints and seams.	11. How to use and care [illegible] machine tools. Box and pan [illegible] slip roll former.
12. Use mallets setting and riveting hammers.	12. Use and care of striking tools.
13. Use hacksaw to square stock.	13. How to use the hacksaw. - blades.
14. File metal to line.	14. How to use files - kinds - cuts - care.
15. Drill a hole in metal with a hand drill.	15. Use and care of hand drills. - sizes - damping.
Fasteners	
16. Prepare metal for rivetting.	16. Kinds of fasteners used. - rivets - machine screws - bolts, etc.
17. Use a rivet set.	17. Techniques of riveting.
18. Soft solder tin plate.	18. How to solder.
19. Tin a soldering copper.	
	20. Types of fluxes
21. Cut threads with a die.	21. How to use a tap and die set.
Machine Processes	
22. Drill holes in metal with high-speed and carbon drills.	22. How to use the drill press. - speeds - clamping.

DO	KNOW
23. Sharpen a drill.	23. Types and uses of drills - sizes - sharpening - clearance.
24. Grind metal for welding.	24 How to use the grinder. - types of stones safety precautions.

Optional The following machine processes may be used as part of the metals program. Time spent on sheet metal operations will need to be reduced when this option is included.

25. Use micrometer to measure diameters.	25. Know how to read a micrometer.
	26. Parts, care and use of lathe.
27. Mount round stock in universal clutch and face turn and centre drill to length.	27. Proper use of combination drill and countersink, types of lathes, dogs, use of calipers.
28. Mount work between centers for turning.	
29. Grind cutter bits.	29. Clearance angles, setting of cutter bit, cutting speeds.
30. Finish turn to size.	30. How to obtain fine finished cut.
31. Knurl stock.	31. How to Knurl.
32. Taper turn with compound rest and off-set tailstock.	32. Methods of taper turning.
33. Filing and polishing.	33. Proper use of lathe files. Correct method of polishing.
34. Machine flat surface.	34. Use of shaper, safety, set up for strike, speed, feed. Types of cutters. Angles of clapper box.
35. Machine at an angle to the finished surface.	35. Set vertical feed to angle of slope and machine using hand feed.

DO	KNOW
Occupational Information	
36. Make a study of one firm that fabricates metal projects to discover skills and training required.	36. Occupations dealing with metal work.
Finishing	
37. Applying metal finishes. - prepare surface. - apply primer - apply paint.	37. Types of finishes and their application.

(7) PLASTICS

Course Content

What the student should be able to:

DO	KNOW
Layout & Design	
1. Choose projects using acrylics and butyrates.	1. (a) History of acrylics and butyrates. (b) Terminology used in plastics.
2. Interpret drawings.	2. Basic reasons for design.
Materials, Source & Application	
3. Identify: acrylics vinyls, butyrates.	3. (a) Classification of plastics (b) Sources of plastics.
4. Layout work on plastic.	4. Methods of layout on plastic.
5. Care for hand tools used on plastics.	5. Types and uses of hand tools for plastics.

DO	KNOW
6. Cut-out stock.	6. Tools and methods for cutting plastics.
7. Square stock.	7. Procedure for squaring stock.
8. File plastic.	8. Care and types of files used for acrylics. - kinds - cuts - care.
Machine Processes	
9. Drill plastics.	9. Types and care of drills used for plastics. - size - clearance - sharpening.
10. Cut plastics with band and jig saws.	10. (a) Safe operation of power tools used on plastics. (b) Power tools used on plastics.
11. Shape plastics with lathe.	11. How to care for and adjust power tools used for acrylics.
12. Sand plastics.	12. Types and uses of sandpaper for plastics.
13. Bend acrylics with heat.	13. How to heat plastics for bending.
Fasteners	
14. Join plastic with cements.	14. Types and application of plastic cements.
15. Join plastic with solvents.	15. Types and application of plastic solvents.
16. Join plastics mechanically.	16. Mechanical fasteners for plastics.
Finishing	
17. Inlay plastics.	17. Differences between inlay and overlay.

DO	KNOW
18. Overlay plastics.	
19. Color plastics.	19. Methods of coloring plastics.
20. Buff plastics.	20. Methods of buffing plastics.
21. Polish plastics.	21. Polishes and methods of polishing plastics.
22. Experimentation and testing of plastic.	22. Safe techniques of working with acrylics.
Occupational Information	
23. Report on place of plastics in industry today.	23. (a) Plastics used in industry. (b) Fields of employment in plastic industries.

Projects

1. Various pulls
2. Keychain ornaments
3. Letter openers
4. Dress clips
5. Jewelry
6. Tie clasps
7. Picture frames
8. Bracelets
9. Candle holders
10. Cigarette boxes
11. Jewelry boxes
12. Letter holders.

(8) INDUSTRIAL CRAFTS

(a) Leather

Course Content

What the student should be able to:

DO	KNOW
Layout & Design	
1. Prepare a design for a project.	1. How to design in leather.
Materials	
2. Select leather for project.	2. Kinds and uses of leather.
3. Layout and cut leather.	3. Methods used for laying out and cutting leather.
4. Moisten leather.	4. Preparation of leather for tooling and carving.
Hand Processes	
5. Condition sharper and store tools.	5. Care of tools.
6. Transfer design to leather.	6. Various ways to transfer designs to leather.
7. Use a swivel knife to carve.	7. Methods of using the swivel knife.
8. Follow tool sequences. - cutting - beveling - background.	8. The proper tool sequences.
9. Use edge creaser.	9. How to do edge creasing.
10. Skive leather.	10. Why and how to skive.
11. Lace using the double buttonhole stitch.	11. Types of lacing.
12. Sew leather.	12. How to fasten parts. - sewing - rivets - glues - snaps.
13. Cement leather.	

DO	KNOW
14. Use rivets.	
15. Use snap fasteners.	
Finishes	
16. Finish with: - dyes - liquid wax - leather sealer - oil.	16. Application of finishes.
17. Clean leather articles.	17. Correct care of leather articles.
Occupational Information	
18. Write a report on a leather industry in Alberta e.g. - shoe factory in Edson - saddlery in High River.	18. What leather industries there are in Alberta and Canada?

Projects

Billfolds, belts, handbags, etc.

(b) Textiles

Introduction

The study of textiles will give an intelligent appraisal of standards and brands of merchandise, an ability to distinguish quality in fabric and the proper use of different qualities.

The history and cultural association as well as the handling of fabrics becomes a fascinating study from the source of the raw materials to the way in which the materials are processed and the products distributed.

As a result of this study, the consumer-merchant and the consumer-customer will know how to buy and what to buy. It is important that students have fabrics to handle and compare.

Objectives

1. Develop interest in textiles.

2. Develop a knowledge of (a) natural fibers, (b) man-made fibers, (c) synthetic fibers.

3. Acquaint student with modern equipment - operation and simple service of each.

4. Give some understanding of the numerous fabrics on the market today and the performance of the particular fabric in this ever-changing picture.

Course Content

What the student should be able to:

DO	KNOW
1. Use a microscope or linen tester.	1. Characteristics of fiber, yarn, and fabrics.
2. Tests for burning, feeling, breaking and chemical test if possible. Collect labels for synthetics.	2. Identification of a natural fiber or some man-made fiber.
3. Yarn count and twist of yarn.	3. The ply of yarn needed.
4. Weave a mat to illustrate plain, twill and satin weave.	4. Know the materials directed to these weaves.
5. Bleach and shrink material. Collect samples of each process.	5. Crease resistance, water repellence and moth proofing.
6. Test a fabric for strength, heat, conductivity, absorption, shrinkage, cleanliness, washability, fastness to color, reaction to acid and alkali.	6. Record results of tests.
7. Man-made fibers. Collect samples of blends and mixtures as in clothing, upholstery and home furnishings.	7. Prospective uses. Samples. Advantages of combination fibers.
8. Synthetics made from elements; carbon, air, water	

DO	KNOW
9. Collect samples of materials and pictures of clothes.	9. The kind of clothes you need for school, social, and sports.
10. Try a variety of products and practice a few grooming techniques. Hand care shoe care, mend and press clothes.	10. Good grooming habits and products on the market to help clean, deodorize and keep you well groomed.
11. Study C.A.C. and apply and compare stores and catalog standards.	11. How to buy and what to buy.
12. Service sewing machine, thread machine, learn parts by using. Sew at least two articles in suggested list.	12. Operation and care of sewing machine and pressing equipment.
13. Plan budget and list clothes needed.	13. Value of clothing dollar.
14. List local firms working with textiles and employment opportunities.	14. Employment opportunities.

- automobile industry - upholstery
- home furnishing
- interior decorating
- mercantile field of buying and selling - managers, buyers, shop operators, specialist shops, ready to wear, yard goodsand notions
- drapery
- tailoring
- repair and mending in laundry
- inventing and processing materials from raw materials to fiber and fabrics.

Activities in Connection with Textiles

1. Smock or cook's apron and cap; cover for a chair or stool.
2. Upholster stool or chair.
3. Game bag, laundry bag, beach bag or Money belt or gun shell carrier.
4. Operation of sewing machine, washing machine, irons.
5. Launder and darn socks and sweater. Iron and fold shirt. Press pants and make a bed. Film on suits, good grooming and proper dress for all occasions.
6. Simple sewing techniques.

(c) Ceramics

Introduction

Ceramics is one of the oldest crafts known to mankind. There are many references to this activity in ancient literature as well as in the Bible. It remains one of the outstanding industrial enterprises in this modern technological world. This craft also is a source of interest to persons concerned with the avocational or leisure phase of living.

This course will provide students with an insight into the manufacture of clay objects as well as develop some basic skill in the manipulation and forming operations in clay.

Course Content

What the student should be able to:

DO	KNOW
	1. Meaning of ceramics. - historical background.
	2. Brief history of pottery.
	3. How to test for good clay.
4. Wedge clay in preparation for use.	4. How to prepare clay for use.
5. Find pictures or samples of the various clay wares.	5. How clay wares differ: - earthenware - stoneware - china - porcelain.
6. Make an article using each of these methods. - coil - propped up slab - draped slab - slab on cylinder with handle and spout - slab on mould - container with lid - form object on potter's wheel.	6. How to form clay.

DO	KNOW
	7. Basic ingredients of glaze.
	8. Meaning of: -opaque -transparent -matt In reference to glazes.
9. Experiment with different types of decoration. - impressed design - inused design - modeled design - underglaze design - multi-glaze effects.	9. Different methods of applying glaze.
	10. How to stack a kiln for firing.
	11. The use of cones in firing.
12. Make a slip mold.	12. How to cast from a mold.
	13. How jiggers and templates are used commercially.
	14. Where ceramic centers are located in Alberta.
	15. The manufacture of brick and tile.
	16. Modern ceramics manufacturing processes.
	17. Occupational opportunities.

Concrete

Processes may be chosen from this group of activities to replace some of those in Ceramics.

18. Mix sample batches of concrete and test --strength --porosity	18. Nature of concrete --composition --proportion of aggregates

DO	KNOW
19. List uses of concrete	19. Methods of forming concrete --placing --finishing --curing --reinforcing --coloring

(d) Lapidary

Introduction

The advantages of a study of lapidary are many. The lapidary art is one of the oldest in the world and mention is made of the cutting of stones in the Bible. The course should give the student an appreciation of the world around them with particular emphasis on the various types, colours, etc., of rocks. Included is a study of rocks, their hardness, types used for architecture and interior decoration. Interest aroused in archeology and ancient times may well motivate a student in his work in social studies.

In learning about rocks and how and where the different types are found, interest should be stimulted in geography and geology.

Objectives

1. To learn to shape and fit specific stones to specific mounts.

2. An appreciation for the beauty of natural stones.

Course Content

What the student should be able to:

DO	KNOW
Material Identification	
1. Color test with streak plate.	1. The Streak test.
2. Experiment with different minerals to compare their hardness.	2. Methods of comparative hardness testing.
3. Study various thin material sections under a microscope.	3. Use of microscope to identify materials.

DO	KNOW
4. Heat test various materials with blowpipe.	4. Heat testing.
5. Flame test by introducing small amounts of mineral into flame.	5. Identify materials through flame color.
6. Perform tests such as: --Magnetism --Cleavage --Fractural --Luster	
Operations	
7. Use machines properly.	7. Operate and care for machines. (e.g. correct speeds for each operation.)
8. Slab rock.	8. Proper thickness for various sizes of stones. Know how to make appropriate settings on saw. How to tighten vise so rock is secure. Proper weights to be used on machine for slabbing. Cut different way for variety of patterns. Know how to orient rocks, (e.g. tigereye.)
9. Lay out pattern.	9. The different sizes of mounts available. Know how to choose correct pattern. Know which template to use.
10. Mark pattern.	10. Type of pencil used and reason for using this type. How to hold pencil correctly. Know importance of sharp pencil.
11. Trim out cabs and trim saw.	11. Proper method of trimming. Know distance to leave between cutting line and cab.
12. Shape cab to fit mount.	12. How to dress and balance grinding wheels. Amount of water to use on wheels. Know how to choose proper grit size for proper stones. Know correct angles for holding rock for grinding. Know also how to choose proper contour for stone.

DO	KNOW
13. Dop stone.	13. How to prepare wax and stick for dopping. How to choose correct size of stick.
14. Sand stone.	14. Amount of water to use if wet sanding. Know correct method of sanding.
15. Polish stone.	15. Different methods of polishing and different polishing compounds used. - cerium oxide - linde A - chrome oxide - tin oxide Know also the different materials used in polishing - felt - leather - maple wood.
16. Set stone.	16. How to set stone. Proper tool used. Importance of correct bezel.
17. Identify occupations related to use of natural rock materials.	

(e) Art Metal

Introduction

This unit in art metal gives students an opportunity to become familiar with various metals; to develop an appreciation of safety practices in metal work and provides activities where they can use their initiative, experiment, express creativeness and develop a sense of pride in individual accomplishment.

Course Content

What the student should be able to:

DO	KNOW
	1. Early history of art metal trades.
2. Identify non-ferrous metals.	2. Metals used: - aluminum - brass - bronze

DO	KNOW
	2. Metals used (cont.): - copper - monel - nickel silver - sterling silver - pewter - zinc based alloys - stainless steel.
3. Design a project.	3. Design in art metal.
4. Use scriber, punches, dividers, sheet metal gauge.	4. Layout procedures and tools.
5. Use the hacksaw, saber saw, snips, drills, punches, files.	5. Methods of cutting, drilling, punching, filing.
6. Anneal copper or aluminum.	6. How to anneal and pickle metal.
7. Do practice jobs in bending, twisting, beating down and raising. This could be part of a single project. (If equipment is available do a metal spinning project.)	7. How to shape art metals by - bending - twisting - beating down - raising - spinning.
8. Decorate small sample pieces of metal 2" x 2" illustrating various decorating techniques. Apply one of these to a project.	8. How to decorate metal. - planishing - fluting - doming - chasing - spotting - stamping.
9. Experiment with various fastening methods and compare strength of joints. - soft solder - hard solder - epony adhesives.	9. How to fasten art metal parts by - soldering - riveting - cementing.

DO	KNOW
10. Prepare a design and etch into metal.	10. How to etch metal. - type of etching - line etching - area etching.
11. Use buffing wheel with various abrasives.	11. How to finish metal projects by - brush finishes - buffing.
12. Discover what tradesman in Alberta use the skills of the art metal work.	

C. GRAPHIC COMMUNICATIONS

Introduction

This course is designed to provide anintroduction to the field of Graphic Communications. The student will be required to learn the basic principles of Drafting, Printing, Duplicating and Photography and the interrelationship of the technologies within this cluster.

The development of a worthy project in Graphic Communications requires foresight in planning, initiation, tenacity to stay with the project until completed, and an understanding appreciation of human reactions to the printed page.

Graphic Communications provides an opportunity for self-expression. The planning, preparation and printing requires analytical and creative ability, therefore, the student has an unusual opportunity to cultivate and develop these qualities that are essential in our industrialized civilization.

Through exploratory contacts the student has a better understanding of the skills necessary in the various processes and procedures of Graphic Communication industry. This enables the student to familiarize himself with the job opportunities in the field of Graphic Communications sufficient to make an intelligent vocational choice.

Unit 9 Drafting

Specific Objectives

1. To develop the ability to read and interpret plans and blueprints.
2. To develop the ability to make multiview drawings.
3. To develop a basic knowledge of drafting skills and its application to industry.
4. To develop the ability to readily apply drafting as an integral part of the shop situation.

Course Content

What the student should be able to:

DO	KNOW
Mechanical Processes	
1. Practice exercise making use of all instruments.	1. Instrument use. - T-Square - Triangles - Scales
	2. Drafting Machine
	3. White Printer
Projection Methods	
Freehand Drawing	
4. (a) Sketch straight lines (b) Sketch cirles and arcs (c) Make approximations of measurements and angles	4. Methods of sketching.
5. Make freehand sketch on a spirit or multilith master	5. Fundamentals of 3 view drawing
Orthographic Projection	
6. From isometric draw and dimension orthographic (straight lines and angles).	6. Review of line and symbol conventions.
	7. Fundamentals of three view projection.
Isometric Projection	
8. From orthographic view draw and dimension simple isometric (straight lines and angles).	8. Fundamentals of isometric.
Pictorial Drawing	
9. Draw cabinet projection given the orthographic view.	9. Other types of oblique drawing.

DO	KNOW
	Sectional Drawing
10. Draw full section of some previous drawing.	10. Conventional lines for full and half section.
	Machine Drawing
11. Draw simple detail and assembly drawing of machine project. (e.g. toolmakers clamp, 4 different parts)	11. Basic machine shop techniques.
	12. Conventional symbols in machining, and m/c allowances.
	Electrical Drawing
13. Draw basic electrical wiring circuits. Series, parallel, etc.	13. Conventional symbols.
	Sheetmetal Drawing
14. Develop drawing of angular scoop.	14. Development of straight and angular surfaces.
	Material Processes
15. Trace a machine assembly drawing.	15. Techniques of pencil tracing.
16. Make and develop a blueprint of the above drawing.	16. Blueprinting process.
	17. Different types of prints.
	18. Various copying machines.
	Relationship To Industry
	Blueprint Reading
19. Read assigned blueprints.	19. Conventional lines and symbols used in all branches of drafting.

Whenever possible the interrelationship between drafting and the other units in Graphic Communications should be emphasized. e.g.

Freehand Sketching - make sketch on plate and duplicate

Orthographic Projection - print isometric view and from this draft orthographic

References

Drafting

Stirling Norman, Technical Drawing, Macmillan Company of Canada

Franch and Svenson, Mechanical Drawing, 7th Edition, McGraw-Hill of Canada

Printing and Graphic Arts

C. W. Hague, Printing and Allied Graphic Arts, Bruce Publishing Co.

Kauffman, Graphic Arts Crafts, Van Norstrand

Albert Koslaff, Art and Craft of Screen Processes, Bruce Publishing Co.

Darvey Carlsen, Graphic Arts, Charles A. Bennet Co. Inc., Peoria, Ill.

Careers in Graphic Arts, Graphic Arts Council, Ottawa

Marinaccio and Osburn, Exploring Graphic Arts, Van Nostrand

Information from Barber Ellis of Alberta Limited - Edmonton, Calgary (upon request)

Unit 10 Photography

Introduction

These units are designed to provide an introduction to picture-taking and darkroom techniques with emphasis on the place of photography in the broad technical area of Graphic Communications. The student will be required to learn basic pictorial composition, exposure data, types of films, contact printing and enlarging. Broad photography areas considered here are commercial photography, portraiture, press photography and industrial photography. The student will be required to keep a notebook, which will contain prints of each picture assignment with brief evaluation of each, as well as information gathered through teacher lecture and demonstration.

Objectives

1. To introduce photography to the student to the point that he will understand the basic materials and processes.

2. To develop a working knowledge in photography.

3. To give the student practice in approved methods and procedures in developing, stopping, fixing, washing and drying films and prints.

4. To acquaint the student with the unlimited opportunities in the photographic industry and its relationship to graphic communications.

Course Content

What the student should be able to:

DO	KNOW
Composition and/or Design	
1. (a) Critical analysis of slides using principles of composition as a guide. Bring a landscape shot for criticism. (b) Organize a notebook.	1. Principles of composition (a) Harmony (b) Proportion (c) Balance (d) Rhythm (e) Simplicity (f) Center of interest (g) Major and minor motif (h) Framing (i) Baseline (j) Lines (k) Color

DO	KNOW
2. Depth of field - Set up and shoot a "lab type" situation to illustrate depth of field, using smallest and largest aperture opening.	2. Lighting (a) Front, back, cross (b) Sun, shade (c) Flash, natural
3. Depth of field - take a picture to illustrate practical use of depth of field.	3. Creativity in composition - expression through photography.
4. Take a picture of a person outdoors. Keep a record of lighting conditions. Use a light meter. Mound print and accumulated data in a notebook.	4. Procedures and problems in outdoor photography. (a) Direct sunlight (b) Shade (c) Fill-in flash (d) Fill-in reflector
5. Take a portrait of a boy or girl using flash bulbs or strobe.	

Materials

6. Evaluate types of film for their specific purposes.	6. Physical structure of film and its reaction to light.
	7. Forms of film in common use (a) Roll (b) 35 M.M. (c) Sheet
	8. Types of film (a) Orthochromatic (b) Panchormatic
	9. Meaning of ASA indices
	10. Enlarging papers (a) Difference between enlarging and contact papers (b) Grades (c) Variable contrast (d) Surfaces (e) Weights (f) Correct safelight to use

Mechanical Processes

Cameras

11. Brief history of photography.

12. Obrain examples and indicate the use of the following in your notebook
    (a) Box camera
    (b) Miniature camera
    (c) Reflex type camera
    (d) Press cameras
    (e) View cameras

12. Kinds and use of following cameras
    (a) Box camera
    (b) Miniature Cameras
    (c) Reflex Type Camera
    (d) Press Cameras
    (e) View Cameras

13. Study and identify parts of the camera.
    (a) Lense - construction, focal length, light wave, properties, aberration, depth of field.
    (b) Shutter - focal planes and between-the-lens shutters.
    (c) Diaphragm - lens opening f-stops EV system.
    (d) Focusing Devices - split image, superimposed, ground glass, depth of field.

14. Loading and unloading the camera.

15. Exposure meters - study and be able to use one proficiently.

15. Rules for correct exposure.

16. Function and use of light meters.

17. Types of flash bulbs
    (a) Classification
    (b) Guide numbers

18. Use of electronic flash
    (a) Synchronization
    (b) Rating

Material Processes

Contact Printing

19. List safety precautions and correct darkroom procedures.	19. Dangers of metal poisoning.
20. Using a normal negative, make a series of exposures ranging from one second to six seconds. Evaluate.	20. What is a contact print.
21. Draw the plan of a darkroom.	21. Darkroom layout.
22. Outline the correct procedures for mixing chemicals.	22. Chemicals -preparation.
23. Using a normal negative make a contact print on Velox ranging from FI to F4. Analyze.	23. Paper - size, surface, tone, contrast, weight.
24. Ferrotype and dry mount prints.	24. Safelights - selection of filters - correct use.
25. Select correct contrast paper and print one under-exposed and one over-exposed negative.	25. A.O.P. papers and contact printing frames.
26. Make a personalized Christmas card.	26. Contact printer - parts and function
	27. Proper methods of developing and printing with regards to temperature and time.
	28. Washing and ferrotyping prints.
	29. Dry mounting techniques.
	30. Methods of stripping negative or to mask.
	31. Loading - sheet film holders - developing tank.
	32. Chemicals and their function
	33. Darkroom procedures.

Enlarging

34. Examine enlarger and identify parts.	34. Types of enlargers.
35. Prepare for enlarging (a) Safelight selection (b) Cleaning negative and carrier (c) Prepare chemicals	35. Functions and parts of an enlarger.
36. Follow correct procedures for enlarging (a) Loading negative (b) Enlarging (c) Focussing (d) Correct aperture opening	
37. Expose test strip at working aperture opening and develop	37. How to make an enlargement
38. Use Kodak print scale to expose a test strip. Develop.	38. Projection control. (a) Spot printing (b) Dodging (c) Cropping (d) Composition
39. Make the enlargement.	
40. Improve original enlargement through use of projection controls.	
41. Write a research paper on a phase of photography as a vocation.	41. Career opportunities (a) Commercial advertising (b) Portraiture (c) Nature photography (d) Process cameraman (e) Training required (f) Industrial photography (g) Police photography (h) Display techniques

References

Neil Stillman, Industrial Arts Work Units in Graphic Arts,
Available from Still-mar Associates, 25 Sherborne Avenue, Lancaster, New York.

Prices are as follows:

* 1 - 5 copies	$1.25 each	51 - 99 copies	$ .60 each
6 - 10 copies	1.00 each	100 - 499 copies	.45 each
11 - 50 copies	.75 each	500 copies	.35 each

* Note: Prices given are approximate

Bookbinding

Hewitt-Bates J.S., Bookbinding, Dryad Handicrafts, Northgates, Leicester

Photography

McCoy Robert A., Practical Photography, McKnight & McKnight

Kodak Data Books - Set - Camera Companies

Morgan Willard D., Graphic Reflex Photography

Duplicating

Gestetner Manuals

L set Kodak Reference Books (Approx. $13.00) consisting of:

W22	Kodak Photographic Notebook
J2	Basic Developing, Printing, Enlarging
G16	Enlarging in Black & White & Color
B1	Filters & Polascreens
G1	Photographic Papers
J1C	Processing Chemicals & Formulae
E74	Color as Seen & Photographed
K13	Darkroom Design & Construction
R20	Kodak Master Darkroom Guide
M1	Copying
E8	Checking with Color
C30	Better 35 m.m. Snapshots

Filmstrips

Among others, the following filmstrips and accompanying tape or script may be purchased (McGraw-Hill) or obtained free on loan from: Ansco Camera Club Services, Ansco of Canada Limited, Cooksville, Ontario.

#10C Projection Printing Part 1
#11C Projection Printing Part 2
#12C Spot Printing & Dodging
#13C Print Contrast Control
#14C Advanced Projection Control
#15C Composition in Printing
#16C Spotting of Prints
#17C Print Presentation
#4C The Brady Exhibit
#8C Portrait Critique
20C Color Photography at Night
#22C Processing Anscochrome at home
#25C Elements of Prize Winning Color Slides

Information on other excellent reference books, films and data sheets, may be obtained from Matt Shykora, 10643 - 61 Street, Edmonton, Alberta

Unit 11 Printing and Reproducing Processes

Introduction

Printing and reproduction processes provide a foundation for the entire field of visual communications. The operations and processes under this heading should be related to the areas of drafting and photography where ever possible. In addition their presentation should include the application of science, mathematics, English, journalism, art and technology where feasible.

Due to the broadness of this area two units of work are outlined under the one heading.

Course Content

What the student should be able to:

DO	KNOW
Composition and Design	
1. Collect from magazines, books and papers type styles and sizes. List according to groups and families.	1. Basic type families.
2. From ATF cards trace a variety of letters noting carefully the shape and form of each letter.	2. Characteristics of type - Sherifs - Italic - Script
3. Find or draw a sample of display or contrast.	3. Meaning of display or contrast.
4. Find or draw a sample of proportion.	4. Meaning of proportion.
5. Find or draw a sample of balance.	5. Meaning of balance.
6. From given copy make a layout first in rough draft, then by pasting up letters from newspapers. Present a final layout.	6. How to make a layout.

DO	KNOW
Materials	
7. Select material for specific purposes.	7. Papers used - History - Type, weight, uses
8. Compare ink types for specific jobs.	8. Types of ink
Mechanical Processes - Platen Press - Typesetting	
9. Draw lines and borders, measure slugs and type to familiarize self with measurement.	9. Printers measurement. Hand composition procedures.
10. From a layout of the case study the location of the various characters. On blank layouts write the characters in correct position.	10. California Job Case
11. Set name to given measure, flush and centered.	11. Use of composing stick.
	12. Justification of line.
	13. Dumping of stock.
14. Set name and address centered on given measure.	14. Use of galley.
15. Tie form.	15. Tying a form.
16. Proof and correct type.	16. Proofing a job with planer and mallet.
	17. Wet proofs, dry proofs, proof presses.
18. Distribute type.	18. Distributing type, leads, slugs, reglets.
	19. The reglet case and furniture case.
20. Set a business card with name address, phone number, proof, correct and tie form and store for later use on platen press.	20. Setting and printing a card.
21. Pull the proof.	

DO	KNOW
Platen Press	
22. Lock up a prepared form using the chaser method.	22. Lock up methods and types. Use of quoins and furniture, accent on chaser method.
23. Cut packing and pack the platen.	23. Preparation of press and of the press packing.
24. Lock up card form, ink press and position card.	24. How to ink the press; position guide pins; wash the press.
25. Feed press without inking and without form, but with guides set.	25. How to feed the press.
26. Lock up and run a business card.	
27. From a prepared logotype or machine cast slug run a memo pad.	27. Paper feeding using grippers.
28. Distribute complete job, wash up and clean up.	28. Distribution of type, reglets, slugs and leads.
Sign Press (Proof Press)	
29. Study operation of sign press, its parts and features.	29. Use of sign press and related equipment
30. Learn position of letters and how they are placed on press.	30. Setting of type and arranging on press.
31. Set single word (name, etc.) place on press. Distribute type.	31. Placing of card on press, pressures of press, removing card, removing type, distributing type.
32. Ink press, place a line on press, position type, position card and pull proof.	32. Inking press.
33. Lay out to dry.	33. Drying printed card.

DO	KNOW
34. Wash press.	34. Washing press.
35. Print a 3-color poster, one color each day, for a dance, concert, club notice, etc.	35. How to use color.
36. Trim the above signs.	36. How to trim.

Unit 12 Printing and Reproducing Processes (Continued)

Mechanical Processes

1. Prepare chart showing the specific advantage of each method or process.	1. Kinds of printing - Letterpress - Intaglio - Lithographic printing - Offset lithography - Flatbed presses - Cylinder press - Rotary press

Material Processes

2. Prepare one stencil of each type.	2. Preparation of stencils (a) Spirit (b) Gestetner (c) Multi-color
3. Student to set up the press and run a previously prepared master.	3. Introduction to off-set. - Principle of off-set duplicating - Introduction to the press - Preparing for operation - Duplicating - Care and wash-up
	4. Off-set ink and paper. - Manufacture - Characteristics
	5. Types of masters. (a) Direct Image (b) Transfer image (c) Photographic

DO	KNOW
6. Prepare a master using a variety of techniques listed under manual preparation, machine preparation and pre-printing.	6. Preparation of direct image masters. (a) Manual Preparation - LeRoy - Pen - Pencil - Crayon - Brush - Stamp Pad - Typewriter (b) Machine Preparation - Typewriter - Teletype - Tabulator - Accounting Machines - Addressograph (c) Pre-Printing Masters - Offset preprinting - Letter press preprinting - Flexographic - Sign press
7. Prepare a job information sheet using the transfer image master.	7. Preparation of transfer image masters. (a) Dry copier (b) Wet copier (c) Electrostalic
8. Produce an offset master.	8. Introduction to dry copiers. - Features - Operation - Production - copying - transparencies - offset masters
	9. Introduction to wet copiers. - Limitations - Preparation of chemicals - Setting up - Exposure - Developing - Copying - Producing masters

References

Drafting

Stirling Norman, Technical Drawing, Macmillan Company of Canada

French and Svenson, Mechanical Drawing, 7th Edition, McGraw-Hill of Canada

Printing and Graphic Arts

C. W. Hague, Printing and Allied Graphic Arts, Bruce Publishing Co.

Kauffman, Graphic Arts Crafts, Van Nostrand

Albert Koslaff, Art and Craft of Screen Processes, Bruce Publishing Co.

Darvey Carlsen, Graphic Arts, Charles A. Bennet Co. Inc., Peoria, Ill.

Careers in Graphic Arts, Graphic Arts Council, Ottawa

Marinaccio and Osburn, Exploring Graphic Arts, Van Nostrand

Information from Barber Ellis of Alberta Limited - Edmonton, Calgary (Upon Request)

Neil Stillman, Industrial Arts Work Units in Graphic Arts, Available from Still-Mar Associates, 25 Sherborne Avenue, Lancaster, New York.

INDUSTRIAL ARTS

POWER MECHANICS

Introduction

Power Mechanics is the study of the sources and transmission of power. Through the reading and activities the student will engage in as he progresses through these units of study he will gain a concept of work, energy and power. It is not within the scope of this course to provide trades training but rather to introduce the students to the broad scope of energy sources, its transmission and application.

Testing and analysis makes up the core of the program. Facilities and equipment must be provided where such a program as outlined below can achieve the results expected.

The general approach in the course is that a student studies:

1. the total system e.g. 4 cycle engine
2. the units that comprise the system: carburetion, cooling, lubricating
3. the components that make up the unit, types of gears, bearings, jets, etc.

The study itself is to revolve around three basic topics:

(a) Principles of operation
(b) Control and analysis
(c) Application

When a, b, and c are applied to the study of 1, 2 and 3 above, an organized and systematic program can be presented.

Although four units comprise a year's work these may vary in length. In some areas such as turbines where equipment may not be available as much time will not be required. More time should then be spent on the other units.

This Power Mechanics course should focus on the application of scientific concepts in technology. Parallels of the utilization of scientific concepts should be drawn between their use in Power Mechanics and other technologies wherever possible. Terms and practices used should be explained scientifically and also as they apply to other technologies.

Specific Objectives

1. To help the student understand the many basic laws and principles of science at work in Power Mechanics and relate these laws and principles to the vast area of power technology.
2. To familiarize the student with the construction and re-requirements of machines which convert energy to useful work.
3. To develop problem-solving related to machines and their operations.
4. To help the student to understand the use, care and control of the power machine.

UNIT 13 - Power Sources

The first unit of the grade ten Power Mechanics course requires a student to study two systems of power sources chosen from the following:

1. 4-stroke cycle gas
2. 2-stroke cycle gas
3. 4-stroke cycle Diesel
4. 2-stroke cycle Diesel
5. Wankel rotary engine

Course Content

What the student should:

DO	KNOW
A. Introduction	
1. Review definition of work, horsepower, torque, revolutions per minute, electrical power, mechanical power.	1. Concepts of Power Concepts of work, energy and power should be understood. Power (P) = Force (F) x Velocity (V) for linear power. P=FV
2. Introduction to measurement of: a. Rotational power	2. a. Power (P) = Force (F) x Lever arm (r) x Angular velocity (w) for rotational power. P=Frw b. Torque (t) = Force (F) x Lever arm (r) t=Fr Rotational Power = t x w

A. Introduction (con't.)

DO	KNOW
	c. Since $w = 2\pi N$ where N is the number of revolutions then P is also equal to: from a. $Fr2\pi N$ from b. $t2\pi N$ Summary: (1) $P = F \times V$ for linear power Rotational Power (1) $P = Frw$ (2) $P = Fr2\pi N$ (3) $P = t2\pi N$
3. Use tools correctly. Identify fastening methods.	3. Proper use of tools and fasteners. Specific uses taught as needed.

B. Principles of Operation

DO	KNOW
1. Study cut-away model with aid of instruction sheet.	1. How this engine delivers torque. How mixture gets in and out of the combustion chamber; how it is ignited; where points of friction are.
2. Go to small shop engine of proper type and read operation instructions.	2. Preventive maintenance steps such as how to check oil, maximum revolutions per minute, starting and stopping procedure.
3. Start and stop the engine.	
4. Measure maximum torque curve on this engine at full throttle with varying loads.	4. Torque characteristics for this type of engine.
5. Compute power output from torque curve.	5. How revolutions per minute offset power output. Practical limitations of power increase with speed.
6. Study sub-systems of engine and identify the parts and their relationship. If necessary dismantle and re-assemble a shop engine of the type being studied	

B. Principles of Operation (con't.)

DO	KNOW
7. Carburetion Study a fuel system to see: a. where fuel comes in and how mixture controlled b. where air comes in c. how mixture gets out of engine d. vary fuel ratios at carburetor or injector; see effect on power output and/or fuel consumption e. experiment with vacuum gauge to see effect of throttle on vacuum f. test fuel pump	7. Principles involved -Bernoulli's Theorem -pressure differential -mixing air and fuel -evaporation by raising temperature -evaporation by reducing pressure -atomization by spraying -law of definite proportions -principles relevant to the system used -Pressure, vacuum, volume
8. Ignition	8. a. Principles of igniting fuel by: (1) battery system (2) magneto system (3) compression (Diesel)
a. Perform an experiment to find effect of spark timing or injection timing on power output on a test engine.	
b. Determine by experiment how crankshaft speed dictates when fuel injection or the spark should occur.	b. Principles of timing spark or injection.
9. Lubrication	9.
a. Perform experiments with friction to include sliding and rolling friction with wet and dry surfaces.	a. Principles of various types of bearings -plain -roller -ball -taper
b. Perform experiments with friction between various types of materials	b. Direction of pressure on various types of bearings.
c. Do dry and wet compression tests on engine with poor rings.	c. Sealing effect of oil.

B. Principles of Operation (con't.)

	DO	KNOW
d.	i. Mix mineral oil and water, also mix M.S. oil and water. ii. Mix oil with anti-freeze.	
e.	Study bearing materials	Bearing materials -dissimilar metals: brass babbit -synthetics: nylon teflon
f.	Do experiments to show pour point and viscosity.	Qualities and ratings of oils. Selecting the right oil for the conditions. Oil additives.
g.	Trace oil path through the engine.	Methods of lubrication.
h.	Run a suitable engine to demonstrate crankcase dilution.	Crankcase dilution Crankcase ventilation
10.	Cooling Systems	10.
a.	Do an experiment to find the temperature drop of water flowing through a small automotive type heater core with air blowing through it.	Principles of heat transfer for air-cooled and liquid cooled systems.
b.	Pressure test on system.	Limitations for each system.
c.	Specific gravity and pour point of anti-freeze.	

C. Control and Analysis

DO	KNOW
1. Perform experiments to show that these three factors control power output.	1. Three factors of power output of internal combustion engine a. Brake Mean Effective Pressure B.M.E.P. b. Total displacement of cylinders c. Piston speed How these three factors can be controlled and altered to increase power and efficiency.
a. Compare power output at a constant speed for different air-fuel ratios.	a. The law of definite proportions.
b. Test volumetric efficiency versus speed for a given engine.	b. How and why volumetric efficiency varies with speed.
c. Displacement - its effect on power output.	
d. Effect of stroke on power and torque curves. Compare two similar-sized engines with different strokes.	
e. Use a small model engine with variable compression ratio to find effect of compression ratio on power output.	
f. Overall efficiency of an internal combustion engine.	f. Practical limitations of piston and crankshaft engines.

Other Practical Activities

1. Discover reasons for
   - Oil consumption
   - Overheating
   - Identify various engine noises

2. Adjust timing
   - Carburetor adjustments
   - Spark plug servicing
   - High-speed tuning

1. Trouble shooting
   - Excessive oil consumption
   - Overheating
   - Engine noises

2. Tune up

D. Applications

The student must be able to relate his understandings to practical applications.

UNIT 14 - Power Sources
(other than those listed under Unit 13)

This unit is to provide an overview of sources of power other than those that were studied in Unit 13.

Sources should include the following:

1. Electric motors, and three others from:
2. Turbines
3. Jets
4. Rockets
5. Nuclear
6. Steam

As some of these systems may not be available in the form of equipment, charts and other visual aids should be used.

Study each system in the same manner as outlined in Unit 13. Consider:

A. Concept of power

B. Principles of Operation:
   1. Carburetion
   2. Ignition
   3. Lubrication
   4. Cooling

C. Control and Analysis

D. Applications

UNIT 15 - Hydraulics and Pneumatics

Course Content

What the student should:

DO	KNOW
1. Inspect a closed hydraulic system - hydraulic brakes, tractor hydraulic system, or lab simulating.	1. Basic principles a. Pascal's Law b. Problems in area c. Concept of pressure
	2. Safety precautions.
3. Set up experiments as outlined in manuals to varify concepts and principles listed in column headed "know". Select manual.	3. Principles of flow and properties of fluids.
	4. Symbols and glossary of terms.
	5. Hydraulic jacks and presses.
	6. The function and principles of operation of various hydraulic pumps - plunger, centrifugal gear, rotor, vane.
	7. Basic hydraulic circuitry a. Single acting cylinder b. Double acting cylinder c. Use of valves
	8. Historical development of pneumatics.
9. Use slides and films.	9. Applications of pneumatics -industrial -marine -mobile -aerospace
10. Compare pneumatic with hydraulic circuits. List advantages and disadvantages of each.	10. Principles of pneumatic circuits.

UNIT 15 - Hydraulics and Pneumatics (con't.)

DO	KNOW
11. Introduce fluidics. e.g. See film or read article on use of fluidics.	11. Basic principle of fluidics.

UNIT 16 - Mechanical Transmission

The mechanical technology unit concerns itself with the transmission of power through a solid medium. A mechanical system is a fully integrated mechanism designed to perform a specific function. An analysis of any mechanical system reveals that there are a number of basic units made up of a variety of components. Not all units will be found in every system but all systems will have some.

The matrix below suggests an approach to analyzing any system.

Unit	Components
Input	Electric motor, internal combustion engine, turbine, solenoid, spring, etc.
Engagement	Friction clutch, pneumatic or hydraulic clutch, magnetic clutch, etc.
Coupling	Universal joints, shafts, levers, pins, gears, belts, etc.
Speed, Torque, Directional Change	Transmission, variable pulleys, planetary gear system, etc.
Power Division	Differentials, cam systems, etc.
Retarding	Brakes, etc.
Output	Cutting tools, wheels, plungers, presses, rams, etc.

Course Content

What the student should:

DO	KNOW
	1. Definition of "power" and related terms "work" and "energy".

Course Content (con't.)

DO	KNOW
2. a. Trace power flow through various mechanical devices i.e. lathe, automobile b. Compare output with input of power transmission system.	2. a. The need for power transmission. b. Mechanical advantage: the relationship between force and distance - torque and speed. c. Directional changes in power transmission. d. Efficiency of power transmission minimizing frictional losses.
3. Experiment on linear measurement of power View film on measurements of draw-bar horsepower. Calculate horsepower developed when climbing stairs.	3. Derivation of: a. Basic formulae used. b. Concept of "Efficiency" c. Linear measurement of power. d. Limitations of transfer of power from wheels to ground.
4. Measure power transmitted through 2 spur gears. Study automotive standard-gear-shift-type transmission. Synchromesh. Calculate possible drawbar pull knowing torque at rear wheels.	4. Basic concept of torque and R.P.M. as the main components of power a. Calculation of torque and power that can be transmitted b. Applications and limitations re gear changes etc.
	5. Concept of changes of R.P.M. and their relation to changes in torque.
6. Calculate power transmitted through belts and pulleys. View films on belt and chain drives.	6. Advantages and limitations of transmission of power by: a. belts b. chain drives.

Course Content (con't.)

	DO		KNOW
7.	Inspect and calculate ratios of various gear arrangements. Determine power transmitted through planetary gears.	7.	a. Concepts of the components and operations of planetary gears. b. Calculation of gear ratios. c. Types of gears - straight, spur, helical cut, bevel, spiral bevel, hypoid, worm, rack and pinion. d. Arrangement of gears in gear sets - countershafts, idlers, planetary, differential, synchronized.
8.	a. Determine the characteristics of a friction type clutch. b. Determine the characteristics of a fluid clutch.	8.	a. The need for disconnecting power flow. b. Clutch systems - dog, sliding gear, one way, centrifugal, cone, single, plate, multiple discs. c. Concept of the force normal to the surface of contact and of the co-efficient of friction. d. Torque limitations of the friction clutch. e. The principles of wet and dry clutch systems. f. Methods of engagement.
9.	Examine and experiment with as many applications as possible.	9.	The principles of mechanical power transmission through a. Shafts - need for shaft supports, bearings, mounting blocks - need for flexibility in drive chain - universal joints, couplers, flexible shafts. b. Cables and ropes c. Cams d. Rods e. Air Screws f. Water Screws g. Axles h. Wedges and Impact Action

Reference List

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6. Motor Services Automotive Encyclopedia, Jud Purvis and William K. Toboldt, The Goodheart-Willcox Company, Inc.

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9. Short Stories of Science and Invention ...
   General Motors Manuals
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10. National Fluid Power Association, P.O. Box 49, Thiensville, Wisconsin

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Engine Charts and Plans	Available from: General Motors Limited Ford Motor Company Chrysler Corporation Limited Caterpillar Tractor Company International Harvester Company Ltd.
Films	Shell Oil Company of Canada Ltd. General Motors Limited
Service Bulletins and Charts	Delco Remey Company Limited
Catalogs and Service Bulletins	Motor Car Supply Limited Snap-On Tools Limited
Service Bulletins and Manuals	General Motor Limited Ford Motor Company Chrysler Corporation Delco Remey Company Limited

Instructional Helps

Projects and Experiments

1. Making of cut-away models of internal combustion engine components (which will in turn provide development of hand skills in filing, fitting, drilling, grinding, sawing and soldering).

2. Experimenting with self-made models of venturi tubes.
Experiments with the prony-brake.
Experimentation with self-made combustion chambers and self-designed high voltage ignition systems.

Instruction Sheets

1. Distribution of weekly prepared information sheets designed as semi-finished notes. Such sheets to reveal the depth and scope of the course requirements.

2. Job sheets instructing students of methods and procedures for disassembly of components and stressing phases of major importance.

3. Question sheets on jobs or projects completed.

4. Assignment sheets for major weekly assignment.

5. A minimum of ten information sheets on the major areas of the course stressing the principles and laws involved in the operation of the unit concerned.

In this course the information sheets should deal with:

1. Measurement of work, efficiency and power.
2. Operation of the internal combustion engine.
3. The principles of combustion.
4. Shop procedure.
5. Principles and properties of lubrication.
6. Cooling systems and their importance
7. Carburetion.
8. Electrical induction.
9. The principles and laws of the internal combustion engine.
10. Auxiliary power units and the transfer of power.

Demonstration Materials

Demonstration materials from industry may be used to an advantage for the teaching of power mechanics concepts. However, the following automotives components are easily obtained and may be used as a starting set of demonstration materials.

E. SPECIAL UNITS FOR INDUSTRIAL ARTS GENERAL

(17) RESEARCH

Introduction

"Reasearch" is a word that appears frequently in educational and industrial publications.

Students need the opportunity, in their progress through the public school, to have some experience with the scientific approach to problem solving. Industrial arts students in particular need to develop a fuller understanding in the area of industrial research. This ten week unit at the high school level will stimulate students to an interest in high level laboratory activities in their quest to satisfy their curiosity.

Background

A number of experimental classes have been conducted in a "Research and Experimentation" in the United States. One that is notable is the Montgomery Hills Junior High School experimental program conducted by Dr. Donald Maley and Alan P. Kenny. This program was based on the concepts presented in a manual written by Dr. Maley of the University of Maryland entitled "Experiments in Industrial Arts". Following is an excerpt from that manual.

"For years educators have been talking about meeting the needs of youth. Industrial arts teachers specifically have done much talking about meeting the needs of youth, and yet upon close examination of the 'Firing Line' or the actual teaching-and learning situation, there appears to be a tremendous gap between the verbalized theory and the practical techniques. Industrial arts educators also have consistently boasted of the uniqueness of their teaching situation (the shop and its equipment, materials, and facilities). Yes, there is the presence of a unique learning atmosphere that is found in no other place in the school. But, to what extent has this uniqueness come to bear on the pupil, teacher, or administrator, or on a sound program meeting the challenge of the fullest development of the individual?

"Perhaps the shop environment is an extremely unique learning situation and perhaps the proponents of the theories of 'pupil needs' are consistent with modern sound educational philosophy. Accepting these two ideas, one might conclude there needs to be a bit of 'gap filling' aimed at using both ideas or conditions toward the common end of meeting the needs of more of the students."

"A step in the right direction might be the identification of needs as they apply to all youth, as they apply to certain groups, and as they apply to individuals. Two facts were of extreme concern to the planners of the project from its inception. First, it is generally the practice that all boys in the junior high school take industrial

rts. Secondly, it is generally agreed that most Industrial rts progr s al chi l in project making. These two facts might lead one to believe that al naturally want to mak projects. However, there might be some question as to the validit of such a statement. And of course the nature and type of project made is in many instances without much decision, planning or control on the part of the student.

"On the other hand there is a different picture that one might consider, since most boys will pass through the shop program, it is entirely possible that many of our future experimenters, physicists, laboratory technicians, chemists, designers, and analysts will be among the group. It is possible that some of these people will early find the urg for exerimentation with materials, tools and equipment. This urge for experimentation and analysis has frequently been evidenced wherever students have had the opportunity. The thesis here is that it is felt that there is within the school shop population a number of boys who have this desire and a need for encouragement and further development. They may not be interested in project making as such, but are bent towards critically evaluating materials and concepts that face them in their daily living. This then, is an educational need. It is a plan for a different type of a shop program aimed at satisfying the needs of those who have the interest, ability and aspiration towards such a progrm and will be of decided value. This proposed program through experimentation is not to be the total shop program in any sense of the word. It is simply advocated as one of the facets which would go to make up a well-rounded program of industrial arts attempting to deal effectively with all the youth who enter into the program."

Purpose

The "research" approach is basically an attempt to put into practice what the best of educational psychology and practice tends to advocate. The purpose of this unit is to give a student the chance to pursue a problem of his own choice. The problems should all be selected by the students and it is the students' curiosity that provides the momentum for the program.

Method

This is a student-centered program. Rather than have teachers select problems for their students and lecture, demostrate and make assignments, students themselves take the initiative.

"The pursuit of the problem by the student involves the development of a scientific approach to the object of his curiosity. He learns and practices the techniques of research. He uses the language of research -- statements of problems, hypotheses, assumptions, variables, findings, conclusions. He soon learns that reading, letter writings, telephoning, visiting, interviewing, and observing are some of the tools he can use in gaining the information he needs. And, above all, he soon learns that the sources of information may take him beyond the teacher, beyond the other teachers in the school, and beyond the county, (provincial) or national boundaries", - Maley in Research and Experimentation.

Basic to the success of the program then, is the involvement of the student in his own problem. Guidance is provided on an advisory basis and through a series of seminars which are held during the time of the research. These seminars provide an avenue of communication and challenge among the young researchers. It is here that the communication skills are developed and the opportunity is provided for individuals to discuss each other's problems and help in their solution. During these discussions problems are raised, ideas suggested, information supplied and the completeness of the research tested.

Facilities

The multiple-activity laboratory provides an ideal facility for the constructing, testing and research activities that the students will need to do. A planning center such as the graphic communications room would serve well for the seminars, the library research, designing and planning and writing activities.

Outside agencies such as the school and public library, government agencies, industrial plants and institutions of higher learning would provide additional resources.

Procedure

A standard procedure should not become established and be used with each student. Different problems will demand variations in treatment. Each student and his research project are unique and should be treated with flexibility. However a few guidelines are suggested below.

1. Explain and outline the purposes and intent of the unit.

2. Explain the standard procedures used in research.
   (a) Selection of the problem or topic for investigation.
   (b) Definition and differentiation of specific aspects of the topic.
   (c) Collection of pertinent data.
   (d) Analysis and interpretation of the data.
   (e) Written report on the research study.

3. Students engage in study, constructing experimental apparatus and collection of data.

4. Seminars are planned to allow students to present their progress and problems. The resulting exchange of ideas should benefit all.

5. The evaluation of the program.

   The evaluation of the work of the students should be based upon the accomplishment of the goals originally set. Some criteria for evaluation follow:
   (a) Reasons for the selection of the problem.

(b) Organization of the problem
- outline of experimental procedure
- effective use of time.

(c) Recording of experimental results
- method used
- accuracy of procedures
- completeness and thoroughness of the work.

(d) Conclusions of the study.

(e) Use and care of tools and equipment.

(f) Individual growth as evidenced by the following personal qualities
- self reliance
- initiative
- creativity
- problem solving
- resourcefulness.

References

Donald Maley, Research and Experimentation, University of Maryland pamphlet.

Kenny and Maley, Montgomery County, Maryland, Research and Experimentation in Industrial Arts, Montgomery Hills Junior High School, Silver Spring, Maryland.

(18) Production Science

Introduction

How are items produced through mass-production? What type of organization and skills are required? This unit is a study and implementation of the production-line technique. It will include the human organization from the president to the salesman as well as the organization of the machines and energy to bring about the manufacture of a useful project.

The unit could be used as the fourth unit of a year's work at any grade level. Preferably the "production line" would incorporate a number of the craft and technical areas found in the laboratory so that the interrelationship of the technologies would become very evident.

The whole class would be organized as the "staff" required to complete the "run".

Course Content

What the student should be able to:

DO	KNOW
1. Make a chart showing the organization of the personnel in a small production plant.	1. The line and staff organization in a manufacturing plant. - lines of authority.
2. Organize class into - management personnel - planners and designers - foremen - production workers - sales personnel.	2. How staff qualifications and job specificiations are determined.
3. Designers draw project for mass production.	3. How products are designed. - priced out; costs - market studied.
4. Management and planners develop flow chart for production of items.	4. Need for flow chart.
5. Foreman and production workers plan standardized procedures for fabricating individual components, setting tolerances, production run, etc.	5. Purpose of jigs and standardization.
6. Run a proto-type through the line.	6. Function of proto-types.
7. Set up one operation that is partially automatic.	7. How automation and cybernation are used to control machines.
8. List reasons for worker dissatisfaction resulting in strikes during the past year.	8. Labor problems. - wage scales - pensions - strikes.
	9. Need for government labor laws and minimum wage scales.
	10. Need for long term planning and research.

Suggestions

1. Have class design a small, inexpensive project that cuts across several craft and technological areas. This might include wood, plastics and metal or sheet metal, plastics and electronics.

   Projects might include:
   - photoframes
   - small transistor radio (vacuum form case)
   - circuit testers
   - book racks
   - items needed in the school
   - etc.

2. Develop mass production activity around one material or technology - e.g. wood, plastics, metal or electronics.

3. The unit can be organiz d around the graphic communication cluster. Publish a newspaper or other such project.

(19) Hot Metals

Acetylene Welding

DO	KNOW
1. Examine diagrams of welding equipment, tips and cutting torch.	1. History of welding. The tremendous effect of welding and its t chniques upon industry. Methods of making and storing acetylene and oxygen, old and new. Cylinders. Regulators and torches.
2. Study oxy-acetylene outfit.	2. The great dangers associated with oxygen and acetylene.
3. Light a torch.	3. How to adjust pressure to get neutral, oxydizing and carbonizing flames and their uses.
4. Join two pieces of 1/8" mild steel.	4. Different meth ds of preparing the base metals. - welding methods - the torchad or puddle weld.

DO	KNOW
5. Break the weld.	5. Difficulties of full penetration.
6. Make a number of welds, horizontal and vertical. Repair students' broken equipment where possible.	6. The main uses of oxy-acetylene welding in industry. Pipe lines, etc.
7. Cut steel using cutting torch.	7. How to use the cutting torch. - cutting with pure oxygen - cutting machines used in industry - pantograph and electronic tracer - cutting cast iron and other metals - the oxygen lance.
8. Brace weld a casting.	8. The technique of braze welding.
9. Braze together two steel parts.	9. How capilliary attraction is used to distribute brass in brazing.
10. Silver solder two pieces of metal together.	10. Uses in industry. Fluxes required.
11. Study diagrams of different types of equipment and that in shop.	11. The basic types of AC and DC generators. The action of the arc in depositing metal. AC DC straight and reverse polevity welding. The industrial implications of arc welding and its enormous increase in the last few years.
12. Strike an arc and run a bead.	12. Classification and color coding of electrodes for various welding operations. Set up the welding equipment. Correct heat and arc length for varying rods and conditions. How to hold an electrode, strike an arc and run a bead. Dangers inherent in this operation.
13. Join two pieces of metal in horizontal position. Butt, lap and tee.	13. Techniques of making a good weld.

DO	KNOW
14. Make a vertical and overhead weld if students are sufficiently able.	14. Know some of the difficulties faced by many welders in industry.
15. Weld up project or repair equipment for the students.	15. The wide range of use of their new found skill.
16. Study a number of objects cast in various metals by different techniques.	16. The extent of the founding industry. Types of casting. Sand, permanent moulding, investment or lost wax, centrifugal, shell molding and die casting. (Note might be made of explosive and magnetic forming which are sometimes considered as casting techniques). Occupations in the industry. Kinds of foundries.

Foundry (optional)

17. Take a simple object and compress between two cuttlefish shells. Make shells into a simple mold.	17. The main principles of casting. The use of this type of casting for jewelry and in earlier times.
18. Make a model in paraffin wax. Use as a pattern and cast.	18. The lost wax process. Its use for jewelry, art works and in industry for small, short run production.
19. Design a simple project for sand casting.	19. Metals available for shop casting. Type metal, cerobond, lead, aluminum. Reasons for shrink rule. Need for draft and rounded fillets.
20. Make up a pattern.	20. Material suitable for pattern making. Pattern making as a trade.
21. Prepare molding sand and flask.	21. Types of casting sand. Equipment used in casting.
22. Prepare the mold for casting.	22. How to make the mold. The use and preparation of cores.
23. Cast the mold.	23. Heating the metal. Use of furnace and crucible. Dangers of molten metal especially with water. Methods used in industry.

DO	KNOW
24. Clean up and finish the model	24. Processes used in finishing sand castings. Advantages of techniques which need little or no finishing.
25. Show a film of an industrial operation.	25. The similarities and differences between this work in the shop and in the factory.

(20) Building Construction

Course Content

What the student should be able to:

DO	KNOW
1. Do exercise requiring the reading of building plans.	1. How to read architectural symbols and lines.
2. Develop the organization of a company.	2. How buildings are planned. - responsibilities of architect - responsibilities of draftsman - financing problems - building costs - job opportunities in drafting and architecture.
3. Choose a location and perform the actions of purchasing a lot.	3. How to choose a site. - securing a lot - what makes a suitable location - zoning laws.
4. Write out a list of steps to follow in the order a building would be completed.	4. How to plan the construction. - purchase of materials - use of sub-trades.
5. Use transit or tape and level to square and level footing forms. (one side only).	5. How to layout a footing.
6. Mix small concrete sample.	6. Basic form design - concrete.

DO	KNOW
7. Cut floor members: - joists and headers - bracing - subfloor.	7. Parts of a floor. - types of sills - names of members - use portable hand saw.
8. Frame a wall with - door - window.	8. Wall framing - doors - windows - nailing.
9. Place ceiling joists. - mark carefully in relation to rafters.	9. How to mark for ceiling joists.
10. Cut a rafter.	10. How to cut a common rafter. (Use a framing square).
11. Nail rafter.	11. How to nail rafters properly.
12. Nail sheathing - wall - roof.	12. Sheathing types - placement - nailing.
13. Describe samples of various exterior finishing materials used in construction.	13. Exterior building finishes.
14. How to lay shingles.	14. How to cover a roof. - types of coverings.
15. Complete portion of walls with drywall, tape and fill.	15. How to finish the interior of a house. - types of finisher - plaster - drywall tips - wood panelling.
16. Study examples of different finishing jobs. Make a list of things to watch for which indicate good craftsmanship.	16. How to do finish carpentry. - hanging a door - baseboards - moldings.
17. Sharpen - a plane - a chisel - a gouge - lathe chisels.	17. How to condition tools. - sharpen - adjust.

DO	KNOW
18. Check general condition of machine tools. - bearings - belts and pulleys - adjustments.	
19. Find samples of materials of different grad s.	19. Grading of Canadian construction woods.
20. Interview a construction contractor to discover - type of training he wants for his employees - skills required - working conditions - job security - how to apprentice - pay rates - how to join a union - how Workmen's Compensation functions.	20. Occupational information.
21. Make several trusses (own design) and test strength.	21. Methods of trussing - design - material.

Suggested Activities:

Small buildins such as dog house, playhouse, garden house, granary. Expendable exercises such as framing a corner, including a window and part of roof.

(21) Food Science

Introduction

To protect his health and build an effeicient body, man needs to give more thought to his diet. Cattlemen and trainers of race horses place great emphasis on the scientific balancing of diet and on the measuring of rations to produce the best results in their animals. It would seem sensible then to study the comparison of foods and the nutritional needs of human beings.

Objectives

1. To develop reasons for safety and sanitation in the kitchen.

2. To develop keener and more intelligent interests in maintaining sensible food habits, and good buying habits.

3. To develop the ability to plan, prepare and serve simple adequate attractive meals for a moderate cost.

4. To develop judgement as to reliability of sources of health information (fads or facts).

5. Operation of modern kitchen equipment.

6. Working knowledge of cooking terms, china, and silverware terms and the proper use of each.

Course Content

What the student should be able to:

DO	KNOW
Safety Procedure	
1. Pupils make safety check of room and equipment. Wear proper dress, white aprons or smock, chef hats or bands.	1. Safety procedures. Safe work habits in relation to dress, traffic lanes and equipment.
2. Practice procedure for treating cuts, burns and scalds.	2. Procedures to be used in case of accidents such as cuts from knives, broken glass, china, burns and scalds
3. Clean up broken glass and spilled grease, etc.	
4. Launder dish towels, dish cloths, aprons. Need for clean clothes. Use of soaps and detergents. Bleaches, chlorine, perborate.	4. Understand sanitation in care, handling and purchasing of foods.
5. Practice route for fire drill.	5. Fire drill - use of extinguishers.

DO	KNOW
6. Clean work areas, refrigerators, stoves.	6. Personal cleanliness.
7. Insect control.	7. Know what kind of insectacide to use.
8. Purchase safe foods from sanitary sources. Pasteurized milk, Government inspected meats.	8. Protection of foods.
9. Clean garbage can, dispose of garbage.	9. Wrapping and storage of garbage.

Understand the spread of infections by food handling and by personal habits.

Nutrition and Management

10. Plan kitchen arrangement and work simplification methods.	10. Good procedures of food service organization.
11. List foods eaten during a 24 hour period.	11. Compare with Canada's Food Guide.
12. Plan a week's menu for a family of four.	12. Know the difference between good and poor meals in nutrients as well as dollars and cents.
13. Make a light, medium and heavy breakfast.	13. Why breakfast is so important.
14. Make quick breads.	14. Uses of quick breads in meal planning.
15. Compare a ready mix with a home mix.	15. Check prices of each.

Fruits

16. Serve raw and cooked fruits.	16. Importance of fruits in diet. Minerals, vitamins. Why a source of Vitamin C is so important.
17. Make fruit desserts, fruit cups, apply crisp and fruit juices.	17. Need for fresh Vitamin C each day.

DO	KNOW
18. Serve cooked dried fruits (prunes).	18. Value in fresh, frozen, canned dried and in season fruits. Prices compared to availability and work needed to serve.
Milk	
19. Show film on milk and dairy products.	19. Ways to buy milk.
20. Milk and value of milk in diet.	20. Care and uses of milk.
21. Study properties of a quart of milk.	21. How to cook with milk.
22. Make milk puddings, custards, sauces, gravies, and milk shakes.	22. Value of cheese in diet.
23. Show film on cheese making.	23. Cheese making and cooking.
24. Macaroni and cheese.	24. Ways of mixing cheeses with other foods.
Eggs	
25. Cook eggs in various wasy.	25. Composition, structure and food value of eggs. Grades and tests for freshness. Methods of cooking eggs, digestibility of eggs.
26. Uses of eggs as binders and extenders in meals.	
27. Prepare eggs dishes.	
Vegetables	
28. Prepare raw vegetables for eating.	28. Value of vegetables in the diet.
29. Consider food values, color flavor, texture, arrangement and cost.	29. Buying, choosing, storing, caring and cooking vegetables.

DO	KNOW
30. Cook vegetables to conserve nutrients.	30. Study buying guides for vegetables.
31. Show film on salad making.	31. Kinds of salads and dressing. Protein, fruit, starch, green and gelatine. Appetizers, accompaniment, main dish and dessert.
32. Make salads, and vegetable plates.	
Meats	
33. Show film on meats.	33. Kinds, structure, grades, care and selections.
34. Cook various cuts of meat, tough and tender cuts, make gravy and soups from stock.	34. Reasons for toughness. Methods of cooking tough and tender cuts of meats.
35. Visit a butcher shop to see meat cut up and name the pieces.	35. Comparative food values of tough and tender cuts, compare prices.
36. Try to use rotisiere, broiler, deep fryer and pressure cooker.	36. Try outdoor cooking with the help of the Gas company or Power Company demonstration.
Occupational	
37. Interview a chef or cook.	37. Study of occupational areas in food services.

Suggested Activities

1. Serve students or parents a Pancake Supper.
2. Make and serve Do-Nuts and Coffee to the Staff.
3. Host a Simple dinner.
4. Try an Out Door Cooking Period.

TESTING AND EXPERIMENTATION

The following suggestions may be used with the appropriate unit.

MECHANICAL

A. Stress/Strain

1. Hooke's Law

2. Non-destructive tests
   a. tension
   b. compression
   c. shear

3. Destructive
   a. tension
   b. compression
   c. shear

B Hardness

1. Birnell

2. Rockwell

C. Toughness/Ductility

D. Impact

E. Fatigue

F. Crystal Structure

1. Cubic

2. Hexagonal

3. Rhombic, etc.

G. Phase Diagrams

H. Electronic & New Methods

1. X ray

2. Gamma ray

3. Ultrasonic

4. Magnetic

5. Magnaflux

6. Polarized light

I. Stress Concentrations

ELECTRICAL

A. Components

1. Resistivity

2. Capacitance

3. Inductance

4. Reactance

5. Dissipation Factor

B. Vacuum Tubes & Semi-Conductors

1. Emission

2. Transconductance

3. Alpha, Beta

4. Leakage

5. Curve tracing

C. Systems Control

1. Frequency; frequency response curves

2. Wave length

3. Distortion

a. harmonic
b. intermodulation
c. hum

4. Signal to noise ratio

5. Gain

6. Square-wave rise time

7. Reliability

8. Counting checks

9. Bolometer antenna gain & radiation tests

CHEMICAL

A. Composition

1. Impurities

2. Additives

3. Isotopes

4. ph Factor

5. Alloying

6. Assay control

7. Plating

8. Catalysts

B. Structure

1. Melting/boiling point

2. colour

3. Odour

4. Taste

5. Thermal conductivity

6. Density

7. Porosity

8. Optical properties

9. Dimensional stability

10. Molecular structure (plastics)

C. Stability

1. Corrosion

2. Oxidation

3. Aging

4. Heat resistance

5. Reaction stability

6. Reagent economy

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2. Feirer, John L., Industrial Arts Woodworking, 1965, Chas. A. Bennett Co.

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4. Miller, Hand and Machine Woodwork, 1962, MacMillan.

5. Lair, C.A., Carpentry for the Building Trades, 1953, McGraw Hill.

Metal

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2. Fraser and Bedell, General Metal, 1962, Prentice-Hall of Canada.

3. Fundamentals of Machine Shop, Sturi.

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7. Machine Shop Training, Krar A. Amand, 1962, McGraw Hill of Canada Ltd.

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9. Workshop Technology, Chapman, 1961, Edward Arnold Ltd.

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How to Run a Lathe.
How to Run a Milling Machine.
South Bend Lathe Works, South Bend 22, Indiana, U.S.A.

11. Arc Welding Lesson - Lincoln Arc Welding Foundation.

12. Welding Help for Farmers - Lincoln Arc Welding Foundation.

13. Procedure Handbook of Arc Welding Design and Practice - Lincoln Arc Welding Foundation

14. Forging and Welding - Robert E. Smith - McKnight and McKnight.

15. Modern Welding Practice - Althouse and Turnquist - Goodhead-Wilcox Publisher.

Plastics

1. C.I.L. Publications handled by United Plastics Limited.

2. Swanson, Plastics, McKnight and McKnight.

3. Cherry, Raymond, General Plastics, 3rd Edition, McKnight & McKnight.

4. Groneman, Chris H., Plastics Made Practical, Bruce Publishing Company.

5. Steele, Gerald L., Fiberglass Projects and Procedures, McKnight & McKnight

6. Lappin, Alvin R., Plastics Projects and Techniques, McKnight & McKnight.

Ceramics

1. Rov, Ceramics, McGraw-Hill

2. Mitchell, Ceramics, Stone Age To Space Age, National Science Teachers Association, 1201 - 16 Street, N.W., Washington 6, D.C., 1965, 50 cents.

3. Thompson, Selley, Activities in Ceramics.

Leather

1. Cherry Raymond, General Leathercraft, General Publishing Co.

2. Zimmerman, Leathercraft, Goodheart-Willcox Co. Inc.

3. Groneman, Leathercraft, Charles A. Bennett Co. Inc.

4. Al Stahlman, How To Carve Leather, Tandy.

Art Metal

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2. Fraser-Bedell, General Metal, 1962, Prentice-Hall.

Lapidary

1. Duke, H.C., The Art of Gem Cuttin , Mineralogist Publishing Company Portland 14, Oregon - $2.00.

2. O'Brien, How To Cut Gems, 1116 North Wilcox Avenue, Hollywood 38 - $1.10.

3. Sinkankas, Gem Cutting, D. Van Norstrand Co., Inc. Princeton, New Jersey - $13.00.

Textiles

1. Fiber to Fabric, Potter and Corban.

2. Fabrics, Denny.

3. Experiences With Clothing, L. Belle Pollard.

4. Library, C.I.L., Teaching Aids Catalog.

Electronics

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2. A. Markus, Basic Electronics, Prentice-Hall.
3. Thwaits, Fundamentals of Electricity, McGraw-Hill.
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Printing

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2. Jackson - Printing - A Practical Introduction to Graphic Arts, McGraw-Hill.
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Drafting

1. French and Swenson, Mechanical Drawing, McGraw-Hill.
2. Stirling, Technical Drawing, Macmillan.

Photography

1. McCoy, Robert A., Practical Photography, McKnight & McKnight.

Power Mechanics

1. Stephenson, George L., Power Mechanics, Delmar Publishing.
2. Automotives Essential, Ray F. Kuns, The Bruce Publishing Company.
3. Duffy, Joseph W., Power, Prime Mover of Technology, 1964, McKnight and McKnight.
4. Crouse, William H., Automotive Mechanics, 5th Ed., McGraw-Hill.

5. Short Stories of Science and Invention - General Motors Manuals
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Service Promotion Department
Oshawa, Ontario

6. National Fluid Power Association, P.O. Box 49, Thiensville, Wis.

Food Science

1. Pollard, L. Belle, Experiences in Foods.

2. Hugh, Introductory Foods.

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4. Balderson, Housekeeping Handbook - How To Do It.

5. Betty Crocker Cook Book.

6. Gas Co. Recipes and Instruction and Operations.

Filmstrips and Films

REFERENCES

Metals

1. McGraw Hill of Canada Limited, 253 Spadina Road, Toronto - Filmstrips.

2. Jim Handy General Films Limited, 1534 Thirteenth Avenue, Regina.

3. Canadian Copper and Brass Development Association, Room 1101, 55 Yonge Street, Toronto.

4. Aluminum Company of Canada, Department of Information 1700 Sun Life Bldg., Montreal 2, P.Q.

5. Tempil, Basic Guide to Ferrous Metalurgy (Chant), from Weldco Welding Supplies, Montreal, Toronto, Quebec.

Filmstrips - Learning Farm Welding with the Arc Welds - Lincoln Welding Foundation.

- Always on the Job - 20 min. filmstrip with record - Air Reduction.

- Industrial Gases & Shield Arc Welding - 27 min. color - sound - Air Reduction.

- Nothing But the Best - 20 min. color-sound - Air Reduction.

- Tools of Many Uses - 18 min. color-sound - Air Reduction.

Movie - Fundamentals of Manual Shielded Arc Welding Techniques - 2 - 20 min. reels color-sound - Air Reduction.

Welding Charts - Lincoln Arc Welding Foundation, 180 Duke St., Toronto

Welding & Cutting Manual - Linde Company of Canada, Division of Union Carbide Company of Canada.

Charts, booklets, etc. - Canadian Welding Bureau, 1393 Yonge Street, Toronto 7, Ontario.

Foods

Krafts Film Strips
McCall Film Strips
Carnation Film Strips
Films from Department.

SOURCES OF SUPPLIES

Plastics

Cope Plastics Illinois, Inc.
Highway 100
Godfrey, Illinois.

Crystal Glass & Plastics, Ltd.
130 Queen's Quay at Jarvis St. - (Dist. for Plexi-Glass)
Toronto, Ontario.

Nidder Manufacturing Co.
75 Crockford Blvd.
Scarborough, Ontario.

Lewiscraft
284 King St. West
Toronto 2B, Ontario.

Natcol Plastics
P.O. Box 299
Redlands, California 92374

Taylor Plastics Ltd.
733-735 10th Ave. S.W. - (Dist. for
Calgary, Alberta Perspex)

The Castolite Co.
Woodstock, Illinois.

United Plastics Ltd.
9531 - 111 Ave. - (Dist. for
Edmonton, Alberta C.I.L.)

Warehoused Plastics Sales
571 Gerrard St. East
Toronto 8, Ontario

Ceramics

Plugged Clay - Sunburst Ceramics
Medicine Hat, Alberta

Plainsman Clays
P.O. Box 15
Medicine Hat, Alberta

Chemicals and Supplies - Alberta Ceramic Supplies
8520 - 67 Avenue
Edmonton, Alberta.

The Pottery Supply House
Box 192
Oakville, Ontario

Wood

Fyfe Smith Hardwood
3640 - 7th St. N.E.
Calgary, Alberta.
or
11203 -- 120th St.
Edmonton, Alberta.

Leather

Tandy Leather Co.
519 Centre St. S.
Calgary, Alberta
or
9757 Jasper Ave.
Edmonton, Alberta

Textiles

Local Stores
Textiles - Patons and Baldwin - Wool
Better Business Bureau pamphlets
A Good Buy Practice
Household Finance Booklet on Money
Management and Clothing Budgets
Classroom Aids for Teachers (Free and up-to-date information)

EQUIPMENT

See equipment lists available from office of Supervisor of Industrial Arts.

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INDUSTRIAL ARTS GENERAL
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